



STATE OF CALIFORNIA Bid Specification

Filter, Air, HVAC

- 1.0 **SCOPE:** This specification establishes the requirements for HVAC (Heating, Ventilating, and Air Conditioning) filters for use in State of California buildings.
- 2.0 **SPECIFICATIONS AND STANDARDS:** Specifications and standards referenced in this document in effect on the opening of the Invitation for Bid form a part of this specification where referenced.
- 3.0 **REQUIREMENTS**
- 3.1 **Applicable to All Filters**
- 3.1.1 Filters shall meet the fire resistance requirements of Underwriter's' Laboratories UL 900, Test Performance of Air Filter Units. Filters shall be UL Class 2 unless otherwise specified. Classifications under UL 900 shall be interpreted as follows:
- Class 1 - Filters which, when clean, do not contribute fuel when attached by flame and emit only negligible amounts of smoke.
- Class 2 - Filters which, when clean, burn moderately when attached by flame or emit moderate amounts of smoke or both.
- 3.1.2 Adhesive coatings used on filter media shall have a flashpoint of not less than 325°F when tested in accordance with American Society for Testing and Materials, ASTM D92, Test Method for Flash and Fire Points by Cleveland Open Cup.
- 3.1.3 Adhesive, when used, shall be self-extinguishing and free of objectionable odor.
- 3.2 **Group I Filter Media Pads:**
- 3.2.1 The filter shall be of the flat panel-type designed and fabricated for disposal when, because of accumulated dust loading, the dust-load limit is reached. The filter media shall be dry or adhesive-coated in accordance with the manufacturer's standard practice.
- 3.2.2 Performance shall be established on the basis of American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), Standard 52-76 or 52.1-1992, Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter. Filter performance requirements at 300 fpm shall be in accordance with the following:

<u>Nominal Thickness (Inch)</u>	<u>Maximum Final Resistance (inch wg)</u>	<u>Maximum Initial Resistance When Clean (inch wg)</u>	<u>Minimum Average Arrestance at Final Resistance (%)</u>
1	1.0	0.12	60
2	1.0	0.15	70

3.2.3 Filter media shall be suitable for the intended use and shall be composed of inorganic fibers. The media shall be nonallergenic and nontoxic. The media shall be suitable for continuous use at a temperature of 150°F. Media for filters normally requiring adhesive shall be furnished with the adhesive applied.

3.2.4 Filter media shall be assembled to provide a progressively dense mat. The filter shall be tinted so as to distinguish the air entering from the air leaving side. To prevent substitution of like products within a manufacturer's line, the product quoted must be readily distinguishable from like or similar products within a manufacturer's media line.

3.2.5 Filters shall be constructed with 90° corners.

3.2.6 Nominal dimensions of the filters shall be as specified in the Invitation for Bid. The actual filter dimensions shall not differ from the nominal dimensions specified by more than the following:

Height:	+0 inch, -5/8 inch
Width:	+0 inch, -5/8 inch
Thickness	+0 inch, -3/8 inch

3.3 **Group II - Non Pleated Filters with Cardboard Frames**

3.3.1 Filter shall meet all requirements of Section 3.2.

3.3.2 Filter shall consist of frame, media, and media retainer. Filters shall be constructed with 90-degree corners. Frame edges shall be parallel to within 3/16 inch. The filter shall be supported on the downstream side in such a manner as to prevent any collapse of the media pack. The media shall be attached to the frame in such a manner that the media pad will not slump or otherwise be permanently displaced at 300 fpm air velocity and final resistance.

3.3.3 Frames of filters shall be formed to provide positive support for the media pad and sufficient structural rigidity for normal handling and installation and removal. Filters shall use wood-pulp products for the frame construction and be sized to reduce moisture absorption.

3.3.4 The media and retaining grids shall be fastened around the entire perimeter of the frame, on front and back, in such a manner as to prevent the media or grids from being dislocated or unfastened from the frame during normal handling and use at maximum air velocity. If the fastening method of the media to the frame is by use of a temperature sensitive adhesive, the softening point of the adhesive shall be a minimum of 155°F when tested as specified in American Society for Testing and Materials, ASTM E28, Standard Test Method for Softening Point by Ring-and-Ball-Apparatus, ASTM E28.

- 3.3.5 Nominal dimensions of the filters shall be as specified in the Invitation for Bid. The actual filter dimensions shall not differ from the nominal dimensions specified by more than the following:

Height: +0 inch, -5/8 inch
 Width: +0 inch, -5/8 inch
 Thickness: +0 inch, -3/8 inch

- 3.3.6 Each filter unit shall be plainly marked with the following:
- A. The name of trade name of the manufacturer or vendor
 - B. UL listing
 - C. The nominal dimensions of the filter
 - D. Air flow direction

3.4 **Group III - Automatic Roll Filter Media**

- 3.4.1 The media roll shall contain a minimum of 65 feet of media of specified width when unrolled from a clean roll. The media shall be constructed of spun glass fibers bonded with a cured thermosetting resin. The media shall be of the progressive density design and shall be coated with an adhesive. Media for AAF core design shall be wound on a metal core.
- 3.4.2 Media shall be reinforced with multi-filament fiberglass cord running parallel to the media length or a heavy duty woven scrim of fire retardant fibers on the air exit side. The reinforcement shall be sufficient to support the media under all conditions from damage or displacement of the air filtration machine sealing frames.
- 3.4.3 The proper size and type of core shall be supplied for various equipment owned by the State. The manufacturer and model number of equipment and/or size and type of core shall be listed on the sub-purchase order.

3.5 **Group IV - Pleated Panel Filters**

- 3.5.1 Each filter shall consist of a non-woven cotton or cotton synthetic blend or fully synthetic media, media support, and enclosing frame. Filters shall have a minimum average atmospheric dust spot efficiency of 25% and a minimum average arrestance of 90% when tested in accordance with ASHRAE 52-76 or 52.1-1992 Standard.
- 3.5.2 Media area requirements and rated face velocity requirements are as follows:

<u>Nominal Thickness</u>	<u>Min. Sq. Ft. Gross Media Area/ Sq. Ft. of Nominal Face Area</u>	<u>Rated Velocity (fpm)</u>
1 in.	2.10	300 - 500
2 in.	4.25	300 - 625
4 in.	6.25	300 - 625

- 3.5.3 The media support grid shall have minimum 90% open area. The media shall be bonded to a welded wire grid or thin expanded metal backing on the air leaving side of the media. There shall be uniform spacing of the pleats to allow for full utilization of the media throughout the entire depth of the pleat. Filters with 4" depth shall be constructed sufficiently to prevent media pack collapse under normal operating conditions.

3.5.4 The enclosing frame shall be constructed of water / moisture resistant die cut "beverage board", designed and glued on all four sides in such a manner as to prevent collapse, by-pass or other failure. Beverage board shall be high strength, moisture-resistance clay coated craft board. The wet tear strengths shall be determined by calculating the amount of weight (in grams) required to tear a board sample after an initial cut is made in the sample. The wet tear strength of the board shall be a minimum of 675 grams on the cross direction and 650 grams in the machine direction when tested per TAPPI T414-OM-82. Note: The industry material product "chip board" is not acceptable in place of the required die cut "beverage board". Filter frames made with "chip board" will be rejected as non responsive to the requirements for die cut "beverage board".

3.5.5 The media pack shall be thoroughly glued to the entire periphery of the beverage board frame and the beverage board frame cross members shall be glued to the individual pleat tops.

3.6 **Group V - Deep Pleated Cartridge Filters**

3.6.1 Each filter shall consist of a series of pre-formed pockets 8, 12, or 24" deep. Pockets shall be formed by accordion pleating of a fire resistance reinforced non-woven cotton or synthetic media. The media shall be bonded on the top and bottom to a moisture resistance fiberboard in such a manner to prevent air bypass. Each pocket shall have a fiberboard spacer that extends into the full depth of the pocket. The spacer shall be part of the top and bottom fiberboard end panels.

3.6.2 Filters shall have a minimum average dust spot efficiency of 25% (without prefilter).

3.6.3 Filters shall have the following minimum media areas:

Nominal Size (in) <u>W x H x D</u>	Minimum Gross Media Area <u>(Square Feet)</u>
16 x 20 x 8	15.0
20 x 20 x 8	19.0
20 x 25 x 8	25.0
24 x 24 x 8	28.0
24 x 24 x 12	41.0

3.7 **Group VI - Extended Surface Supported Pleat Filters**

3.7.1 Each filter shall consist of a pleated media pack and a galvanized metal filter frame. The filter shall be rated Class 1 per Underwriters Laboratories, Test Standard 900. The filter frame and header shall be constructed of galvanized steel and constructed in such a manner to insure integral strength with a leak-free seal. The media shall be made from ultra-fine glass fibers and be water resistant. The media shall be pleated using corrugated aluminum separators. Filters shall be available with a single header, double header, or no header.

3.7.2 Filters shall have a minimum average dust spot efficiency of 60% with a face velocity of 500 fpm.

3.7.3 Filters with single header configuration shall have the following minimum media areas:

Nominal Size (in)
W x H x D

Minimum Gross Media Area
(Square Feet)

12 x 24 x 12

45.0

24 x 24 x 12

100.0

3.8

Group VII - Extended Surface Collapsible Pocket Filters

3.8.1

Filters shall consist of high density fiberglass filter media formed into dust holding compartments and secured to a corrosion resistant header. The filter pockets shall consist of filter media bonded to a backing material and formed into channels using span stitches which help provide for full pocket inflation and full utilization of the entire media area.

3.8.2

The header shall be constructed of corrosion resistant material to which the pockets are attached. The headers shall be of sufficient strength and design to assure uniform spacing for each pocket and an air-tight seal in the applicable air velocity range. The header shall be constructed such that there are no sharp edges, pinch points, or gaps that would allow the filter media to be cut, abraded, or torn or otherwise allow dirty air by-pass. Headers shall include individual pleat dividers constructed of corrosion resistant material.

3.8.3

Headers shall be available in the following thicknesses: 0.75" - 0.88" and 1.05" - 1.19". Each filter size listed in the Invitation for Bid shall be available in either of the two header sizes at no additional cost. State institutions shall indicate header size required on sub-purchase order.

3.8.4

Filters shall meet the following requirements:

Nominal Size (in) WXHxD	No. of Pockets	Minimum Gross Media Area (Square Feet)	Minimum Ave. Atmospheric Dust Spot Efficiency (%)
24x24x22	8	58	55
12X24X22	4	29	55
24X24X21	6	42	40
24X24X22	8	58	80
24X24X14	6	28	40
12X24X21	3	21	40

3.8.5

Depth dimensions shown are nominal. Actual depth dimensions may vary from what is shown by +/-2".

4.0

CERTIFIED INDEPENDENT LABORATORY TEST REPORTS

Certified independent laboratory test reports for the specific filters indicated in Table II shall be provided as follows:

- A. The certified independent laboratory lab test report shall bear the signature and stamp of a registered professional engineer responsible for testing.
- B. Test reports shall include applicable size and performance data as indicated in Table II.

- C. The certified independent laboratory test shall be performed on a filter acquired on the open market by the testing laboratory. The test report shall state that the filter(s) tested were acquired on the open market.
- D. The test report shall be in accordance with ASHRAE Standard 52-76 or 52.1-1992.
- E. A direct reproduction, such as a Xerox copy of a certified test report that can be easily recognized as such, is acceptable.
- F. Ordinary published catalog data is not acceptable in lieu of the certified test report.
- G. The test report shall be current for the filter offered and shall be less than 8 years old on the bid due date contingent upon filter media design/performance and fire resistance requirements of Underwriter's Laboratories UL 900 remain unchanged.
- H. The certified test report shall represent the performance of the filter brand/model number/media/construction offered in the bid.

5.0 **Test After Receipt of Order:** After award of contract, State of California may randomly select one or more filters for independent tests. The tested filters shall meet the requirements Air-Conditioning Refrigeration Institute, ARI 850-78, Standard for Commercial and Industrial Air Filter Equipment.

Initial Resistance

- A. Published values must be in multiples of 0.01" W.G.
- B. Tolerances-initial resistance cannot exceed published resistance by more than 10% or .02" water, whichever is greater.

Initial Atmospheric Dust Spot Efficiency

- A. Published values must be in multiples of 5%.
- B. Tolerances-average atmospheric dust spot efficiency shall be not less than the Published Efficiency (Ei) - $[3 + .08 (100 - Ei)]$. Refer to Table I for a comprehensive listing of calculated values.

Average Synthetic Dust Arrestance

- A. Published values must be in multiples of 5%.
- B. Tolerances-average synthetic dust arrestance shall be not less than the Published Arrestance (Aa) - $[2 + .06 (100 - Aa)]$. Reference to Table I for a comprehensive listing of calculated values.

Dust Holding Capacity

- A. Published values must be in multiples of 10g. (For filters in Group II - Automatic Roll Filters, the values must be in multiples of 10 g. per square foot)
- B. Tolerances - Dust holding capacity shall be not less than 90% of published capacity.

NOTE: Published values are defined as those values shown in the manufacturer's published literature.

TABLE I
STANDARD RATINGS AND TOLERANCES
FOR AIR FILTERS

Based on ARI Standard 850-78 as determined by the ASHRAE Standard 52-76 or 52.1 - 1992 Test Method

<u>INITIAL EFFICIENCY</u>		<u>AVERAGE EFFICIENCY</u>		<u>AVERAGE ARRESTANCE</u>	
Published Rating	Minimum Allowable Initial Efficiency	Published Rating	Minimum Allowable Average Efficiency	Published Rating	Minimum Allowable Average Arrestance
85%	80.8%	95%	91.7%	100%	97.9%
80%	75.4%	90%	86.4%	95%	92.7%
75%	70.0%	85%	81.1%	90%	87.4%
70%	64.6%	80%	75.8%	85%	82.1%
65%	59.2%	75%	70.5%	80%	76.8%
60%	53.8%	70%	65.2%	75%	71.5%
55%	48.4%	65%	59.9%	70%	66.2%
50%	43.0%	60%	54.6%	65%	60.9%
45%	37.6%	55%	49.3%	60%	55.6%
40%	32.2%	50%	44.0%	55%	50.3%
35%	26.8%	45%	38.7%	50%	45.0%
30%	21.4%	40%	33.4%	45%	39.7%
25%	16.0%	35%	28.1%	40%	34.4%
20%	10.6%	30%	22.8%	35%	29.1%
15%	5.2%	25%	17.5%	30%	23.8%
10%	.2%	20%	12.2%	25%	18.5%
				20%	13.2%

TABLE II
REQUIRED CERTIFIED TEST REPORTS

GROUP	III	IV	IV	V	VI	VII	VII	VII
Nominal Filter Size (in.) (WidthxHeightxDepth)	NA	24x24x2	24x24x4	24x24x12	24x24x12	24x24x21	24x24x22	24x24x22
Filter Face Velocity (FPM)	500	500	500	500	500	500	500	500
Test Air Flow Rate (CFM)	2000	2000	2000	2000	2000	2000	2000	2000
Maximum Initial Resistance (Inches W.G.)	0.20	0.40	0.30	0.25	0.5	0.35	0.5	0.55
Final Resistance (Inches W.G.)	NA	1.0	1.0	1.0	1.5	1.0	1.0	1.20
Minimum Average Atmospheric Dust Spot Efficiency (%)	NA	25	25	25	60	45	55	80
Minimum Average Arrestance (%)	75	90	90	NA	NA	NA	NA	NA
Minimum Dynamic Dust Holding Capacity (Grams/Sq.Ft.) at .5" W.G.	50	NA	NA	NA	NA	NA	NA	NA
Minimum Dust Holding Capacity Per Filter (Grams) @ 1.0" W.G.	NA	110	150	400	NA	400	425	200
Minimum Dust Holding Capacity Per Filter (Grams) @ 1.5" W.G.	NA	NA	NA	NA	270	NA	NA	NA
Lower Operating Resistance (Inches W.G.)	0.40	NA	NA	NA	NA	NA	NA	NA
Upper Operating Resistance (Inches W.G.)	0.50	NA	NA	NA	NA	NA	NA	NA
Minimum Gross Media Area (Sq. Ft.)	NA	NA	NA	NA	NA	42	58	58
Number of Pockets	NA	NA	NA	NA	NA	6	8	8

NA - Not Applicable